

Dynamics of Fencer Rating Progression

Ethan Xu
Lexington High School
Lexington, MA

Abstract—This study quantitatively investigates fencers’ progression to an A rating, the highest rating in fencing, and explores several underexplored aspects of this journey. It provides an overview of 8,413 fencers of all ages and then focuses on 5,536 fencers of age 22 or younger for more detailed analysis. The key findings show that there were about twice as many A-rated fencers for épée compared to foil and saber and that the épée fencers also progressed significantly faster to an A rating. The northeast region (Region 3) and the southwest region (Region 4) had more A-rated fencers than other regions, but there was no significant difference in fencer rating progression time across regions. Interestingly, while earning a first rating at an earlier age is strongly associated with an earlier age to get A rating, it slightly elongates the time from the first rating to the first A rating. In addition, the difficulty of obtaining higher ratings increases progressively as fencers advance. These insights provide valuable, data-driven guidance for optimizing training strategies and talent identification.

Keywords—Fencer growth, rating, progression time, age, region, épée, foil, saber.

I. INTRODUCTION

Fencing is an Olympic sport with a long history. USA Fencing ratings [1] rank fencers by skill on a scale from E (lowest) to A (highest), with D, C, and B in between, for each weapon (épée, foil, or saber). Fencers without ratings are designated U (unrated). Ratings are earned in competitions by achieving certain placements, with the year of earning (e.g. A2025) and the strength of the tournament impacting their value. Rated fencers who fail to earn a higher rating or renew their current rating after four years will have their rating dropped to the next lowest letter. Ratings are used for tournament seeding, eligibility for certain events, and as an indicator of skill progress. Understanding how fencers progress through the ratings and exploring factors that impact a fencer’s progression provides invaluable insights for talent identification, optimized training methodologies, and strategic competitive planning.

The previous research related to fencing has been primarily focused on tactical and technical analysis [2], biomechanical analysis [3], physiological analysis [4], and injury analysis [5]. However, the dynamics of longitudinal fencer rating progression remains an unexplored space even though coaches and fencers possess anecdotal knowledge about the journey of rating progression.

This study addresses this gap by providing a quantitative analysis of the fencer rating progression using the longitudinal data of all the fencers with a rating. This study first gives an overview of the current fencer rating distribution across weapons, ages, and regions. Then it focuses on the fencers of age 22 or younger to give a more in-depth view of the rating

progression dynamics. It investigates the progression time by weapon and region, and the association between age of the first rating and fencer rating progression. In addition, it examines the difficulty of earning subsequent ratings as fencers progress from lower ratings to higher ratings.

II. METHODOLOGY

A. Data Collection

The data includes all the épée, foil, and saber fencers ($n = 8,413$) who are/were active members of USA Fencing with a rating on August 19, 2025. The data for this study was collected through a programmatic approach, utilizing a custom-built Python script to extract information from a publicly accessible fencer tracking website (fencingtracker.com). This website was selected for its comprehensive historical rating data, which includes the specific date each fencer first obtained each rating (E, D, C, B, and A). In addition, regional affiliation data for each fencer was also gathered to facilitate geographical analysis.

B. Analysis Questions and Statistical Methods

Fencer Rating Progression by Weapon – To compare the progression speed among three weapons (épée, foil, and saber), the time taken to get the first A rating from their first rating for each A-rated fencer was calculated. Given the non-normal distribution of progression times, the non-parametric Kruskal-Wallis test was used to test for significant differences in medians across the three weapon groups. If it indicated a significant difference ($p < 0.05$), further multiple comparisons were performed using Dunn’s test to identify specific pairwise differences. For fencers with A ratings in more than one weapon, the data analysis only included the progression data for the weapon in which an A rating was received at a younger age.

Fencer Rating Progression by Region – There are six regions across the United States (Fig. 1). To investigate regional differences, the Kruskal-Wallis test was applied to compare the median time from first rating to the first A rating across different geographical regions.

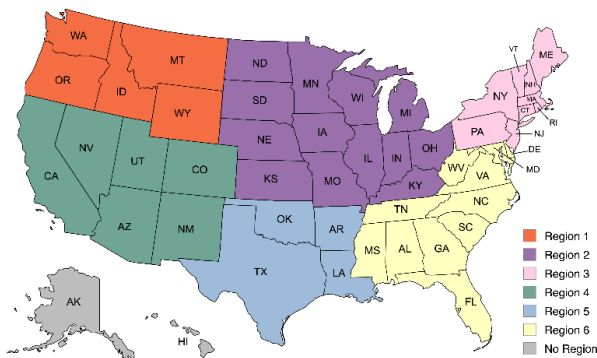


Fig. 1. Regions defined by USA Fencing.

Association between Age of First Rating and Progression Speed – Two sets of scatter plots were created for each weapon to illustrate the age of the first A rating against the age of the first rating and the time taken to get the first A rating against the first rating. Correlation between the two sets of variables was assessed with Pearson’s coefficient.

Progression Difficulty from Lower to Higher Ratings – Kruskal-Wallis tests were used to determine significant differences in difficulty between consecutive rating progressions. To quantify the increasing difficulty of obtaining higher ratings, a Markov chain approach was utilized, with an A rating being treated as an absorbing state. Transition matrices were constructed based on observed fencer movements between rating states (E, D, C, B, and A) for each weapon, and the self-loop probability was examined to determine difficulty of progression.

C. Data Analysis and Visualization Tools

Statistical analysis was conducted in Python 3.11.1 using `scipy` (1.15.3), `pandas` (2.2.3), `numpy` (1.26.4), and `scikit-posthocs` (0.11.4). For data visualization, `matplotlib` (3.9.0), `seaborn` (0.13.2), and `D3.js` (7.9.0) were used.

III. RESULTS

Among all the 8,413 fencers with a rating in the data set, 5,524 (66%) fencers were men, 2,553 (30%) fencers were women, and 336 (4%) fencers’ gender information was missing. The distribution of the ratings for each weapon is shown in Table I, with 728 fencers having a rating in more than one weapon.

The distribution of 8,413 fencers by age was visualized with a histogram (Fig. 2). The fencers’ age ranged from 10 to 88, and the biggest number of rated fencers were at the age of 17 ($n = 841$, 10%), most of whom were likely juniors or seniors in high school.

Among 8,413 rated fencers, 1,637 were A-rated fencers, whose distribution across states was shown in Fig. 3. The top three states with A-rated fencers were California ($n = 307$), New York ($n = 262$), and Massachusetts ($n = 168$). In terms of regions, Region 3 ($n = 612$) and Region 4 ($n = 376$) had most A-rated fencers.

TABLE I. ÉPÉE, FOIL, AND SABER FENCERS ACROSS RATINGS

Rating	Épée	Foil	Saber
A	825 (20%)	440 (15%)	372 (17%)
B	662 (16%)	360 (12%)	316 (14%)
C	848 (21%)	488 (17%)	413 (19%)
D	771 (19%)	604 (21%)	428 (19%)
E	1,013 (25%)	1,003 (35%)	699 (31%)
Overall	4119 (100%)	2895 (100%)	2228 (100%)

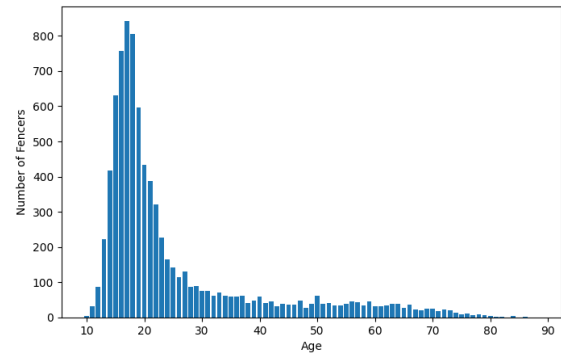


Fig. 2. Distribution of fencers with ratings across ages ($n = 8,413$).

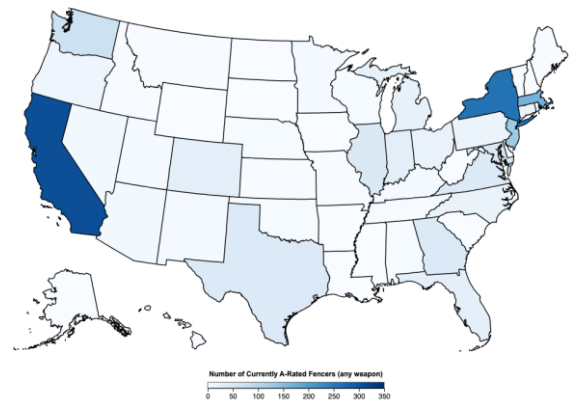


Fig. 3. Distribution of A-rated fencers across states.

To provide insights for the development of fencers from the start of their fencing career to their graduation from college, a subset of the data with fencers aged 22 years or younger ($n = 5,536$) was used for further analysis. Among these fencers, 3,414 (62%) were men, 1,936 (35%) were women, and 186 (3%) did not have gender data. For the seven fencers who had A ratings for foil and épée, their primary weapon was determined by their earliest A rating and the data from the non-primary weapon was excluded in the analysis. When analyzing progression time, fencers whose rating got reverted to a lower rating due to no new rating or no renewal of the original rating within four years, also had their data excluded from the data analysis.

A. Fencer Rating Progression by Weapon

Among the 5,536 fencers aged 22 years or younger, there were 895 A-rated fencers, including 413 épée fencers, 247 foil

fencers, and 235 saber fencers. The box plots (Fig. 4) show the distribution of the progression time from their first rating to the first A rating for each weapon, with the median time of 1.807 years, 2.349 years, and 2.086 years for épée, foil, and saber, respectively.

Based on the Kruskal-Wallis test, the median progression time from the first rating to the first A rating across the three weapons was significantly different ($p < 0.001$). For further pairwise analysis, Dunn's test was conducted with a Bonferroni correction, revealing a significant difference in median progression time between épée and foil ($p < 0.001$) and between épée and saber ($p = 0.002$), but not between foil and saber ($p = 0.45$).

B. Fencer Rating Progression by Region

The distribution of rated fencers ($n = 5,536$) across regions and the A-rated fencers for each weapon in each region are shown in Fig. 5. There was one fencer who was from Hawaii, where no region is assigned by USA Fencing. Regions 3 and 4 (northeast region and southwest region) had the most rated fencers (2,039 and 1,271 fencers) and the most A-rated fencers (446 and 263 fencers) whereas Regions 5 and 1 had the fewest rated fencers (289 and 312 fencers) and the fewest A-rated fencers (29 and 57 fencers). Regions 3 and 4 had the highest A-rated fencer ratio (21.9% and 20.7%) whereas Regions 5 and 2 had the lowest A-rated fencer ratio (10.0% and 17.2%).

The Kruskal-Wallis test indicated that median progression time from the first rating to the first A rating across the six regions was not significantly different for épée ($p = 0.26$), foil ($p = 0.40$), or saber ($p = 0.46$). The median time for progression from first rating to the first A rating in each region for each weapon is shown in Fig. 6.

C. Association Between Age of First Rating and Progression Speed

Correlation between the age of first rating and that of the first A rating was explored with scatter plots (Fig. 7). Pearson's correlation coefficient (Pearson's r) was calculated for each weapon. There was a strong positive correlation between the two variables across the three weapons ($r = 0.671$ for épée, $r = 0.618$ for foil, and $r = 0.624$ for saber).

A similar analysis was conducted to investigate the relationship between the age of first rating and the time interval from first rating to A rating. Scatter plots with regression lines were generated to visualize the relationship between these variables for each weapon (Fig. 8). The correlation between the two variables is negative across three weapons, although the strength of correlation varies, with weak correlation for épée ($r = -0.180$) and saber ($r = -0.263$), and moderate correlation for foil ($r = -0.423$). These results indicate that, for all weapons, it took slightly longer for fencers with an earlier first rating to get the first A rating.

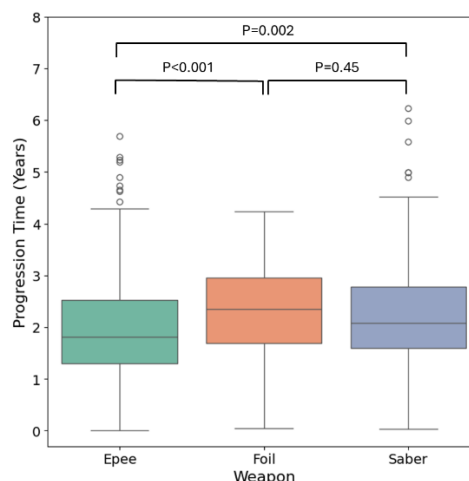


Fig. 4. Fencer progression time from fencers' first rating to their first A rating across weapons. Each bar runs from the first (Q1) to the third (Q3) quartile. The short line within each bar indicates median, and the whiskers indicate 1.5x interquartile range (IQR). Outliers beyond the whiskers are displayed as open dots.

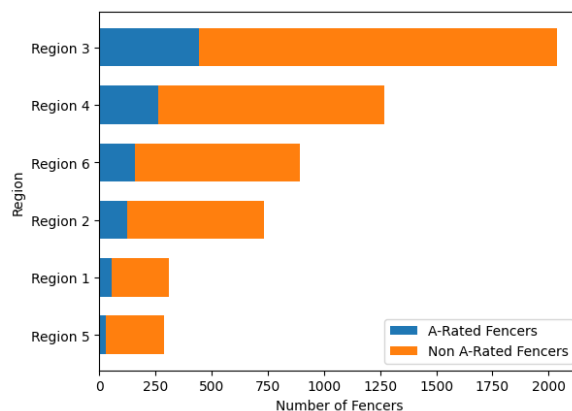


Fig. 5. A-rated versus non-A-rated fencers for each region.

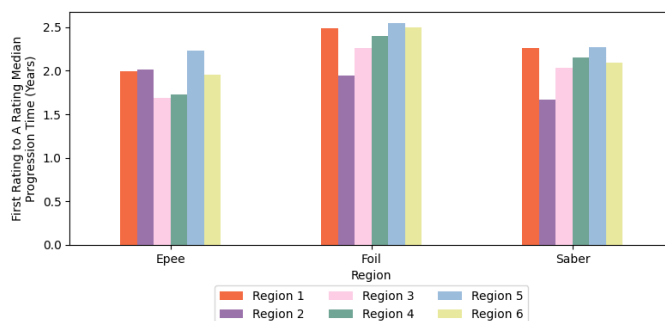


Fig. 6. Median progression time from first rating to first A rating per weapon and per region.

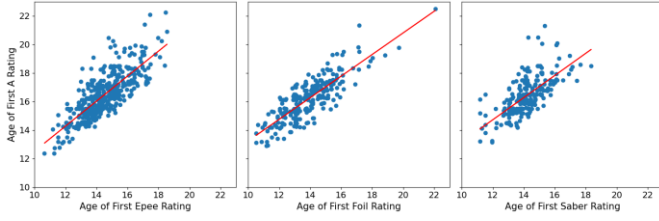


Fig. 7. Association between age of first rating and age of first A rating.

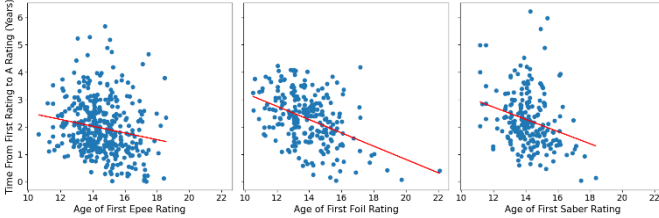


Fig. 8. Association between age of first rating and time to progress from the first rating to the first A rating.

D. Progression Difficulty from Lower to Higher Ratings

To visualize the progression along the rating scale, the time spent at each rating before earning an A rating was plotted in a radial stacked bar charts (Fig. 9) for all the fencers with A ratings in each weapon, except for those who directly earned an A rating. Fig. 9 demonstrates that the progression time to the first A rating varied greatly across fencers, ranging from less than 1 year to almost 6 years and that most fencers spent a long time at a B (green color in Fig. 9) rating before they finally earned the first A rating compared to other ratings.

To further investigate the stepwise progression speed, the median time taken to progress between consecutive ratings in years for each weapon was calculated (Table II) and visualized using a bar chart (Fig. 10). Overall, the median progression time became longer with higher rating, with the one from B to A the longest for each weapon (0.919, 1.013 and 0.83 years for épée, foil and saber, respectively).

Kruskal-Wallis tests were used to determine if the time taken to progress between consecutive ratings was significantly different across the ratings for each weapon. A significant difference in the median time taken to progress across the steps was found for each weapon ($p < 0.001$ for épée and foil, $p = 0.003$ for saber). Pair-wise Dunn's tests for each weapon revealed a significant difference in progression time for all comparisons ($p < 0.05$) with the following exceptions: E to D versus D to C progression ($p = 0.88$) for épée, E to D versus D to C progression ($p = 0.63$) and C to B versus B to A progression ($p = 0.96$) for foil, and E to D versus D to C progression ($p = 0.89$) and C to B versus B to A progression ($p = 0.36$) for saber.

A Markov transition matrix was also constructed for consecutive rating progressions in each weapon for all fencers except those with only one rating in each weapon (Fig. 11). Generally, the probability for a fencer to stay at their current rating (diagonal values in orange boxes in Fig. 11) was progressively higher from E to B for each weapon, which indicated more difficulty to advance when fencers moved to a higher rating.

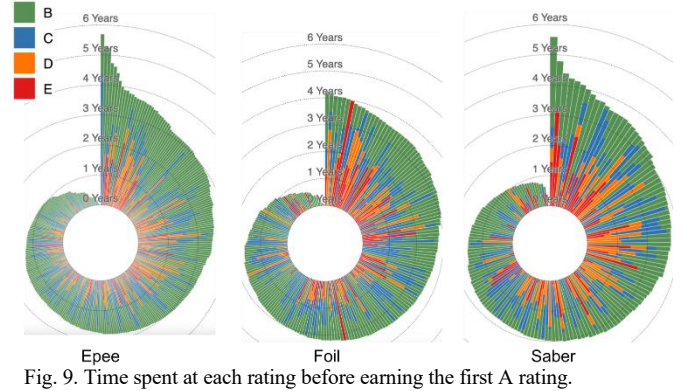


Fig. 9. Time spent at each rating before earning the first A rating.

TABLE II. MEDIAN PROGRESSION TIME BETWEEN CONSECUTIVE RATINGS

Progression	Épée (years)	Foil (years)	Saber (years)
E to D	0.539	0.706	0.715
D to C	0.520	0.712	0.674
C to B	0.668	0.994	0.789
B to A	0.919	1.013	0.830

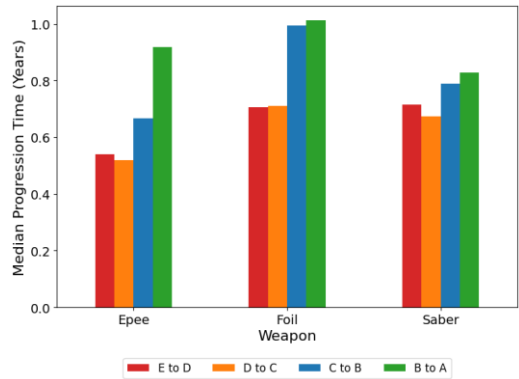


Fig. 10. Comparisons of median progression time across consecutive rating progressions for each weapon.

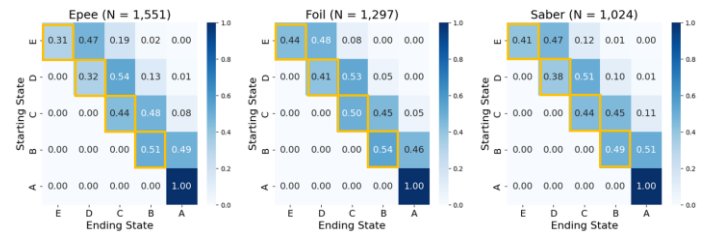


Fig. 11. Markov transition matrix across ratings for three weapons.

IV. DISCUSSION

This study provides the first analysis of fencer progression data focused on fencers from their youth to college years, revealing how fencers progressed in their ratings.

The data shows that rating progression is different across weapons, with épée fencers progressing faster than foil and saber fencers. The median time to progress from the first rating (typically E) to the first A rating was the longest for foil (2.349 years) and shortest for épée (1.807 years) with saber in the middle (2.086 years). There may be several reasons for this. The épée discipline does not use “right of way” to determine touches, which could make the discipline more intuitive and easier for new fencers to learn. This could also introduce more randomness into competitions, allowing for a wider range of fencers to get their A rating and speed up their progress to an A rating as well. In addition, épée has the most fencers among three weapons, and therefore the most competitions for épée fencers to potentially progress to a higher rating.

While there was no significant difference in the median progression time across regions for all weapons, The northeast region (Region 3) and the southwest region (Region 4) had the highest number of rated fencers and the highest proportion of A-rated fencers across all weapons. This finding is consistent with the population distribution of the United States and the number of fencing clubs in each region. More fencers and more fencing clubs could mean more competition events, and therefore more opportunities to progress toward a higher rating. Furthermore, the more rated fencers in a region or in a fencing club, the more efficient a fencer’s practice/training could be and the faster a fencer could progress to a higher rating, which forms a positive feedback loop accelerating the progression for the fencers in the region overall.

While the study indicates that fencers who earn their first rating at an earlier age also tend to earn their first A rating at an earlier age, a somewhat unexpected finding is that earning a rating at an earlier age does not necessarily mean that a fencer will progress faster to an A rating. From the data, for fencers who got their first rating earlier, it would take them slightly longer to get their first A rating. Various hypotheses could explain this phenomenon. Younger fencers could still be exploring their favorite sport without being able to commit to fencing whereas those who started at an older age might have made the commitment and could show more dedication immediately. Additionally, fencers who started fencing in competitions at an older age are often more mature than those who started at a younger age. Fencing is deemed to be like “mental chess”, which requires physical strength and a mature mind, meaning fencers who started at an older age may tend to progress faster. Another reason could be that the fencing scene in the United States has seen an influx of international fencers, many of whom are at the high school age. These older fencers often enter competitions with a pre-existing skillset, allowing them to progress quickly compared to fencers who may have just begun learning fencing.

Finally, it is more difficult to move up as the ratings get higher, with the most difficult progression appearing to be from B to A. This was demonstrated by the longer progression time at higher ratings as well as the higher probability of staying at

the same rating at higher ratings in the Markov transition matrix. There could be a “diminishing returns” effect at higher ratings, as fencers need stronger results in higher-level competitions. Therefore, the amount of practice may not translate as well to earning ratings for fencers at a high level.

This study focuses on fencers’ longitudinal rating progression, which is an important aspect of fencer growth and was not explored previously. Future research could benefit from additional longitudinal data that tracks fencers’ other developmental aspects (such as physiological and psychological aspects as well as tactics and strategies). That would help depict a more complete fencer growth journey.

V. CONCLUSION

This study provides a quantitative view of a fencer’s progression through the fencing rating system in the United States. It was found that épée has almost twice as many A-rated fencers compared to foil and saber. Épée fencers progressed fastest among all three weapons but there was no significant difference in progression time between foil and saber fencers. The northeast region (Region 3) and the southwest region (Region 4) had the most fencers and most A-rated fencers. The earlier a fencer got their first rating (such as E), the faster the fencer tended to get their first A rating, but with a longer progression time toward their first A rating. Moreover, the difficulty of progression increases as fencers move up through the rating system. These insights can help fencers, coaches, and parents better understand athlete development and inform decisions about training and competitions in the sport.

ACKNOWLEDGMENT

I would like to thank my fencing coach Ralf Bissdorf and my AP Statistics teacher Andre Verner for inspiration and guidance in this research.

REFERENCES

- [1] United States Fencing Association. USA Fencing Athlete Handbook 2025-26. 2025. [Online]. Available: https://www.usafencing.org/rules-compliance#Athlete_Handbook_cs38. Accessed: August 31, 2025.
- [2] M. Zhang, L. Chen, X. Yuan, R. Huang, S. Liu, and J. Yong, “Visualization of technical and tactical characteristics in fencing,” *J Vis*, vol. 22, no. 1, pp. 109–124, Feb. 2019, doi: 10.1007/s12650-018-0521-3.
- [3] S. Aresta *et al.*, “Combining Biomechanical Features and Machine Learning Approaches to Identify Fencers’ Levels for Training Support,” *Applied Sciences*, vol. 12, no. 23, p. 12350, Dec. 2022, doi: 10.3390/app122312350.
- [4] L. Bottoms *et al.*, “Physiological demands and motion analysis of elite foil fencing,” *PLoS ONE*, vol. 18, no. 2, p. e0281600, Feb. 2023, doi: 10.1371/journal.pone.0281600.
- [5] B. Stanicki, J. X. Criscione, A. L. Shaari, K. Thompson, and B. Galdi, “An Analysis of Fencing Injuries in the United States: A 10-Year Database Review,” *Orthopaedic Journal of Sports Medicine*, vol. 13, no. 4, p. 23259671251334774, Apr. 2025, doi: 10.1177/23259671251334774.